CLAIMS

1. A method for preventing mammalian cell migration, comprising:

inducing a functional Ena/VASP protein in a mammalian cell in an effective amount for preventing cell migration.

2. The method of claim 1, wherein the functional Ena/VASP protein is induced by contacting the mammalian cell with an Ena/VASP activator.

3. The method of claim 2, wherein the Ena/VASP activator is a plasma membrane targeting compound that targets the endogenous Ena/VASP protein to the plasma membrane.

4. The method of claim 3, wherein the plasma membrane targeting compound is an Ena/VASP binding molecule conjugated to a plasma membrane targeting domain.

5. The method of claim 4, wherein the Ena/VASP binding molecule is an EVH1 binding molecule.

6. The method of claim 5, wherein the EVH1 binding molecule is a FPPPP peptide.

7. The method of claim 5, wherein the EVH1 binding molecule is a peptide mimetic.

8. The method of claim 2, wherein the Ena/VASP activator is exogenous Ena/VASP protein.

9. The method of claim 1, wherein the functional Ena/VASP protein is induced by expression of exogenous Ena/VASP protein in the cell.

10. The method of claim 1, wherein the mammalian cell is a tumor cell.

11. The method of claim 10, wherein the tumor cell is *in vitro*.

12. The method of claim 10, wherein the tumor cell is *in vivo*.

13. The method of claim 1, wherein the Ena/VASP protein is Mena.

14. The method of claim 1, wherein the Ena/VASP protein is VASP.

15. The method of claim 1, wherein the Ena/VASP protein is Mena and VASP.

16. The method of claim 1, wherein the Ena/VASP protein is Mena and Evl.

17. A method for preventing tumor cell metastasis in a subject, comprising:

administering to a subject having or at risk of developing a metastatic cancer a plasma membrane targeting compound in an effective amount for preventing cell migration in order to prevent tumor cell metastasis.

18. The method of claim 17, wherein the functional Ena/VASP protein is induced by contacting the mammalian cell with an Ena/VASP activator.

19. The method of claim 18, wherein the Ena/VASP activator is a plasma membrane targeting compound that targets the endogenous Ena/VASP protein to the plasma membrane.

20. The method of claim 19, wherein the plasma membrane targeting compound is an Ena/VASP binding molecule conjugated to a plasma membrane targeting domain.

21. The method of claim 20, wherein the Ena/VASP binding molecule is an EVH1 binding molecule, and wherein the EVH1 binding molecule is selected from the group consisting of a FPPPP peptide, and a peptide mimetic.

22. The method of claim 18, wherein the Ena/VASP activator is exogenous Ena/VASP protein.

23. The method of claim 17, wherein the mammalian cell is a tumor cell.

24. The method of claim 17, wherein the Ena/VASP protein is selected from the group consisting of Mena, VASP, Mena and VASP, and Evl.

25. A method for identifying a therapeutic Ena/VASP activator or inhibitor, comprising:

contacting a mammalian cell with a putative Ena/VASP activator or inhibitor,

determining the effect of the putative Ena/VASP activator or inhibitor on cell migration, and

identifying an Ena/VASP activator when the mammalian cell has a decreased rate of migration or an Ena/VASP inhibitor when the mammalian cell has an increased rate of migration with respect to an untreated control mammalian cell.

26. A method for identifying a therapeutic Ena/VASP activator or inhibitor, comprising:

contacting a mammalian cell with a putative Ena/VASP activator or inhibitor,

determining the intracellular location of endogenous Ena/VASP, and

identifying an Ena/VASP activator when the endogenous Ena/VASP is localized in the plasma membrane or an Ena/VASP inhibitor when the endogenous Ena/VASP is localized to a membrane of an intracellular organelle.

27. The method of claim 26, wherein the putative Ena/VASP activator or inhibitor is selected from the group consisting of an activator or inhibitor obtained from a peptide library of compounds, an activator or inhibitor obtained from a small molecule library of compounds, an activator or inhibitor obtained from a peptidomimetic library of compounds, and an activator or inhibitor obtained from a mixture of compounds identified using an anti-idiotypic antibody.

28. A method for promoting cell migration, comprising:

depleting a mammalian cell of a functional Ena/VASP protein to promote cell migration.

29. The method of claim 28, wherein the functional Ena/VASP protein is depleted by contacting the mammalian cell with an Ena/VASP inhibitor.

30. The method of claim 29, wherein the Ena/VASP inhibitor is an Ena/VASP binding molecule conjugated to an intracellular targeting domain that targets Ena/VASP protein to a surface remote from the plasma membrane.

31. The method of claim 30, wherein the Ena/VASP binding molecule is selected from the group consisting of an EVH1 binding molecule, a FPPPP peptide, a peptide mimetic, and an Ena/VASP antisense molecule.

32. The method of claim 28, wherein the Ena/VASP protein is selected from the group consisting of Mena, VASP, Mena and VASP, and Evl.

33. A method for promoting wound healing, comprising:

contacting a mammalian cell involved in wound healing with an Ena/VASP inhibitor to promote migration of the mammalian cell to the site of the wound.

34. The method of claim 33, wherein the Ena/VASP inhibitor is administered *in vivo* to a subject at the site of the wound.

35. The method of claim 34, wherein the Ena/VASP inhibitor is an Ena/VASP binding molecule conjugated to an intracellular targeting domain that targets Ena/VASP protein to a surface remote from the plasma membrane.

36. The method of claim 34, wherein the Ena/VASP inhibitor is an Ena/VASP antisense molecule.

37. A method for promoting tissue generation comprising,

contacting mammalian cells of a tissue type with an Ena/VASP inhibitor to promote actin polymerization and tissue formation on a scaffold.

38. The method of claim 37, wherein the scaffold is an artificial scaffold *in vitro*.

39. The method of claim 37, wherein the scaffold is an artificial scaffold *in vivo*.

40. The method of claim 38, wherein the scaffold is implanted *in vivo* once the tissue has generated.

41. The method of claim 37, wherein the scaffold is a naturally occurring tissue scaffold *in vivo*.

42. The method of claim 37, wherein the mammalian cells are fibroblasts.

43. The method of claim 37, wherein the mammalian cells are nerve cells.

44. The method of claim 43, wherein the Ena/VASP inhibitor is administered to a site of damaged nerve cells in a subject and wherein the scaffold is a naturally occurring tissue scaffold.

45. A method for preventing neurodegeneration, comprising:

administering to a subject at risk of neurodegeneration an Ena/VASP inhibitor in an amount effective to prevent neurodegeneration.

46. The method of claim 45, wherein the Ena/VASP inhibitor is administered locally to the site of neurodegeneration.

47. The method of claim 45, wherein the Ena/VASP inhibitor is administered to a nerve cell *in vitro* and the nerve cell is delivered to the subject at the site of neurodegeneration.

48. The method of claim 45, wherein the Ena/VASP inhibitor is administered in a sustained release vehicle at the site of neurodegeneration.

49. The method of claim 45, wherein the subject has or is at risk of developing Alzheimer's disease.

50. The method of claim 45, wherein the subject has or is at risk of developing a neurodegenerative disorder selected from the group consisting of Down Syndrome; Parkinson's disease; amyotrophic lateral sclerosis (ALS), stroke, direct trauma, Huntington's disease, epilepsy, ALS-Parkinsonism-dementia complex; progressive supranuclear palsy; progressive bulbar palsy, spinomuscular atrophy, cerebral amyloidosis, Pick's atrophy, Retts syndrome; Wilson's disease, Striatonigral degeneration, corticobasal ganglionic degeneration; dentatorubral atrophy, olivo-pontocerebellar atrophy, paraneoplastic cerebellar degeneration; Tourettes syndrome, hypoglycemia; hypoxia; Creutzfeldt-Jakob disease; and Korsakoff's syndrome.

51. The method of claim 49, wherein the Ena/VASP inhibitor is administered in an effective amount for preventing Ena/VASP proteins from interacting with FE65.

52. A method for enhancing learning and memory, comprising:

administering to a subject an Ena/VASP inhibitor in an amount effective to enhance learning and memory.

53. The method of claim 52, wherein the inhibitor is targeted to the brain.

54. The method of claim 52, wherein the Ena/VASP inhibitor is administered in an effective amount for inhibiting the activity of Mena in a synapse of the subject.

55. The method of claim 52, wherein the subject has or is at risk of developing a learning disorder selected from the group consisting of Alzheimer's disease, Creutzfeld-

Jakob disease, brain damage, senile dementia, Korsakow's disorder, and age-related memory loss.

56. A method for disrupting learning and memory, comprising:
administering to a subject an Ena/VASP activator in an amount effective to disrupt learning and memory.

57. The method of claim 56, wherein the activator is specifically targeted to the brain.

58. The method of claim 56, wherein the Ena/VASP activator is administered in an effective amount for promoting Ena/VASP protein - FE65 interaction.

59. A composition, comprising,
an Ena/VASP inhibitor in an effective amount for promoting cellular migration and a pharmaceutically acceptable carrier.

60. The composition of claim 59, wherein the Ena/VASP inhibitor is an Ena/VASP binding molecule conjugated to an intracellular targeting domain that targets Ena/VASP protein to a surface remote from the plasma membrane.

61. The composition of claim 59, wherein the Ena/VASP binding molecule is an EVH1 binding molecule.

62. The composition of claim 61, wherein the EVH1 binding molecule is a FPPPP peptide.

63. The composition of claim 61, wherein the EVH1 binding molecule is a peptide mimetic.

64. The composition of claim 59, wherein the Ena/VASP inhibitor is an Ena/VASP antisense molecule.

65. A composition, comprising,

an effective amount for preventing cellular migration, of an Ena/VASP activator in a pharmaceutically acceptable carrier.

66. The composition of claim 65, wherein the Ena/VASP activator is a plasma membrane targeting compound that targets the endogenous Ena/VASP protein to the plasma membrane.

67. The composition of claim 66, wherein the plasma membrane targeting compound is an Ena/VASP binding molecule conjugated to a plasma membrane targeting domain.

68. The composition of claim 67, wherein the Ena/VASP binding molecule is an EVH1 binding molecule.

69. The composition of claim 68, wherein the EVH1 binding molecule is a FPPPP peptide.

70. The composition of claim 68, wherein the EVH1 binding molecule is a peptide mimetic.

71. A modified cell, comprising:

an Ena/VASP negative cell.

72. The cell of claim 71, wherein the cell is a fibroblast.

73. The cell of claim 71, wherein the cell is a mammalian cell.

74. The cell of claim 71, wherein the cell is a Mena/VASP double negative cell.

75. A method for identifying a therapeutic compound for inhibiting cellular migration, comprising:

contacting a cell of claim 71 with a putative compound for inhibiting cellular migration, and

determining the effect of the putative compound on cellular migration, wherein a putative compound which inhibits cellular migration is a therapeutic compound.

76. A compound, comprising:

an actin binding domain and a cell motility domain, wherein the compound does not include a Listeria motility domain.

77. The compound of claim 76, wherein the actin binding domain is a peptide sequence corresponding to amino acids 411-429 of Mena or a conservative substitution thereof.

78. The compound of claim 76, wherein the cell motility domain includes a conserved EVH1 domain.

79. The compound of claim 76, wherein the cell motility domain is a peptide sequence corresponding to amino acids 1-280 of Mena or a conservative substitution thereof.

80. The compound of claim 76, wherein the compound is a peptide having a sequence corresponding to a conservative substitution thereof.

81. The compound of claim 76, wherein the compound is a peptidomimetic.

82. A modified Ena/VASP protein, comprising: the amino acid sequence of the mature peptide of SEQ ID NO: 2 wherein at least one amino acid residue has been substituted and wherein the substitution is selected from the group consisting of (a) a non-conservative or conservative substitution of a serine residue corresponding to position 236 or 376 of SEQ ID NO: 2; (b) a non-conservative substitution or deletion of

one or more residues corresponding to position 411-429 of SEQ ID NO:2; (c) a conservative substitution of at least one residue corresponding to position 281-344 of SEQ ID NO: 2; (d) a non-conservative substitution or deletion of at least one residue corresponding to position 281-344 of SEQ ID NO: 2; and (e) a non-conservative or conservative substitution or deletion of one or more residues corresponding to position 411-429 of SEQ ID NO:2.

83. A method for identifying a therapeutic compound for inhibiting or promoting cellular migration, comprising:

screening one or more putative compounds for the ability to interact with an actin barbed end to identify an actin binding molecule,

determining the effect of the actin binding molecule on cellular migration to determine whether the actin binding molecule is a therapeutic compound for inhibiting or promoting cellular migration.

84. A composition identified by the method of claim 83.